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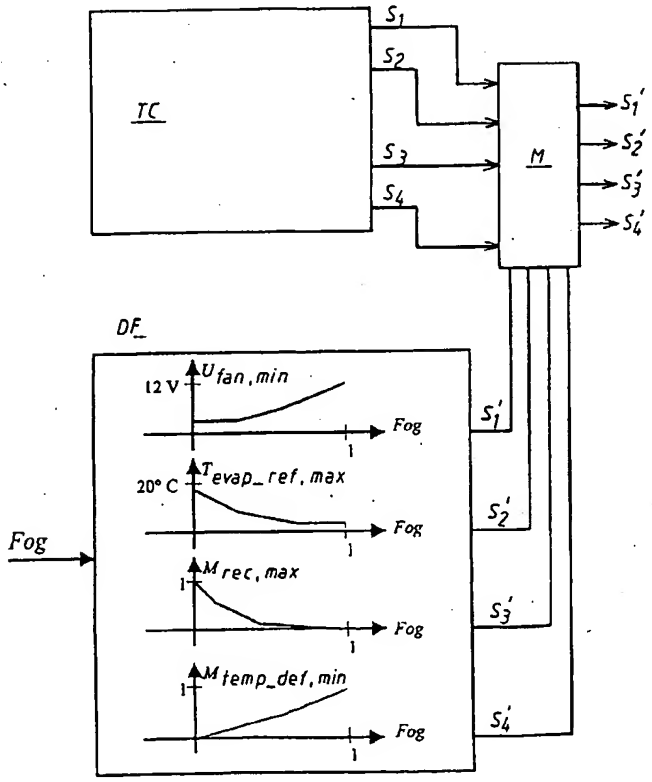
(54) Title: DEVICE AND METHOD FOR AUTOMATIC DEFROSTER IN CARS



(57) Abstract: The invention relates to a method and a device for an automatic defroster function for a surface in a car, comprising a sensor for detecting the presence of mist or ice on said surface, means for generating control signals, on the basis of the sensor data, for a number of functions in the car for an optimum defroster function on said surface, means for receiving these control signals, and means for receiving control signals from a temperature regulator in the car for a number of functions in the car. A number of the control signals from the temperature regulator are intended to control the same functions as the control signals for the optimum defroster function, and the same means are used for receiving control signals for optimum defroster function and for receiving some of the control signals from the temperature regulator, and the means for receiving control signals are intended, in the event of conflict, to select those control signals which are designed to give the best defroster function.

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DEVICE AND METHOD FOR AUTOMATIC DEFROSTER IN CARS.

TECHNICAL FIELD

The present invention relates to a device and a method for automatic demisting and deicing, a so-called defroster, for a surface, for example a window, in a car.

BACKGROUND ART

A common way of regulating the passenger compartment temperature in a car is to use so-called automatic climate control, which is a function which generates control signals for a number of different functions in the car, for example a built-in air-conditioning system, so that the desired passenger compartment temperature is maintained.

A further aim of automatic climate control can be to ensure that the car windows, primarily the windscreen, are kept free of mist, a so-called defroster function. For this purpose, the automatic climate control ensures that dry and warm air is directed at the windscreen. Since the climate control system does not know whether the windscreen is misted up or not, this will occur irrespective of requirements, and since the control, heating and cooling of air are measures which require energy, fuel consumption consequently increases irrespective or requirements. Some of the adjustments which are made by the automatic climate control in order to achieve the desired passenger compartment temperature can additionally run counter to the object of achieving optimum demisting.

If the windscreen is completely or partially covered with ice, possibly in combination with mist, the climate control system will perhaps be unable to direct sufficient amounts of dry and warm air at the windscreen, in which case the driver has to take some course of action, for example press a button

to activate the desired demisting function. This applies for example in cases where the windscreen has suddenly iced over as a result of driving into a cold environment.

Sensors which detect the presence of mist or ice on a surface such as a car window are already known and can function according to a number of different principles, for example by optical detection or by detection of air moisture. However, how information from such a sensor is to be used together with a climate control system in a car in order to give optimum and automatic demisting is not known.

DISCLOSURE OF THE INVENTION

The problem solved by the present invention is therefore that of using information from a sensor for detecting the presence of mist or ice on a surface, for example a car window, and, with the aid of a system for climate control or temperature regulation in the car, to achieve optimum automatic demisting, defroster function, on said surface.

This problem is solved according to the invention with the aid of a device for an automatic defroster function for a surface in a car, which device comprises a sensor for detecting the presence of mist or ice on said surface, means for generating control signals, on the basis of the mist sensor data, for a number of functions in the car for an optimum defroster function on said surface, and means for receiving these control signals. The device also comprises means for receiving control signals for a number of functions in the car from a function for temperature regulation.

In the device, some of the control signals from the temperature regulator are intended to control the same functions in the car as the control signals for the optimum defroster function, and the same means are used for receiving control signals for optimum defroster function and for receiving a number of the corresponding control signals from the temperature regulator, and the

means for receiving control signals are intended, in the event of conflict, to select those control signals which are designed to give the best demisting. This ensures that an automatic and efficient defroster function can at all times be achieved using a device according to the invention. The fact that the control signals selected are the ones which give the most demisting means that when the function for optimum defrosting has generated a control signal giving less defrosting than the temperature regulator, the control signal from the temperature regulator is selected.

Since the invention provides the possibility of selecting which of the control signals from the temperature regulator are connected to the same means as the control signals for the defroster function, it is possible to determine which of the control signals from the temperature regulator will be included in this selection.

The means for generating control signals for an optimum defroster function can preferably also include means for storing and reading off the values for the functions of the respective control signals, where the stored values give the optimum defroster function for certain input data from the sensor for detecting the presence of mist or ice. In this way, suitable or optimum values for the respective functions for different input data from the mist sensor can be calculated or tested out and stored in advance and then used as and when required.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in greater detail below on the basis of illustrative embodiments and with reference to the attached drawings, in which:

Figure 1 shows a diagrammatic representation of a climate control system in a car,

Figure 2 shows a number of graphs for automatic defrosting according to the invention, and

Figure 3 shows an alternative use of the graphs in Figure 2.

ILLUSTRATIVE EMBODIMENTS

Figure 1 gives an overview of the different functions in a system 100 for automatic climate control in a car. The main functions are as follows: a valve 110 which controls how much of the air drawn into the system will come from the passenger compartment or the environment outside the vehicle, a fan 120, an evaporator 130 which forms part of an air-conditioning system, a heat valve 140 which controls how much of the air in the system will be guided past a heat source, and one or more valves 150 which regulate in which direction or directions in the car the air from the system for climate control is to be guided.

The system also includes a sensor 160 for detecting the air temperature after air-conditioning, and which is used to control the air-conditioning so that the desired degree of air humidity can be achieved.

On the basis of a number of input or set values, the system 100 for automatic climate control will generate, for the abovementioned functions, control signals which are intended to give the desired passenger compartment temperature. The values which are input can include the outside temperature, the strength of the sun, and of course the selected passenger compartment temperature which has been set.

According to the invention, a sensor is used which can detect the presence of mist or ice on a surface in order to detect mist or ice formation on a car window, preferably the windscreen. However, similar sensors can of course be used to detect the presence of mist on other windows or surfaces in the car. The sensor outputs a value which indicates whether there is mist or ice on the window and, if so, how much. The sensor is preferably calibrated so that the value lies between zero and one, or, alternatively, the output signal from the sensor is scaled so that it lies between zero and one.

To ensure that the optimum defroster function is achieved, the invention includes means which, on the basis of the value from the mist sensor, generate control signals for a number of the functions in the system for automatic climate control, as is shown diagrammatically in Figure 2. These functions will be controlled for optimum defroster function on the basis of the value from the mist sensor and include the voltage to the fan for controlling the speed of rotation of the fan, the air temperature after air-conditioning, the degree of recirculation of the air in the climate control system, and control of the air temperature in the passenger compartment via the position of the heat valve.

Since the temperature regulation and the automatic defroster function in the car will generate their individual sets of control signals for a number of functions in the climate control system, a "conflict" may arise. According to the invention, this is solved by the fact that a number of the control signals for the temperature regulation and a number of the control signals from the defroster function are connected up to a means which, if there are different control signals for one and the same function, will select one of the control signals, and the control signal which is selected is the one which gives the most demisting. It should be noted that the control signal which gives the most demisting is not always the control signal generated by the defroster function. If there is no mist on the window, the defroster function will for example generate a control signal for a low fan speed, which means that the temperature regulation can generate a control signal for a higher fan speed, which gives a greater defrosting effect.

The means for selecting the control signal can be realized in many different ways, either using hardware or software, but preferably using software.

As regards the control signals for the heat valve position which are generated by the defroster function or temperature regulation, these control signals can

be treated in different ways: they can either be connected up to the means for selecting a control signal, so that the valve position selected is the one giving the best demisting, or the passenger compartment temperature can be given priority for this control signal. In a preferred alternative embodiment of the invention, the passenger compartment temperature is given priority.

The selection of the control signal is illustrated in Figure 3, where the system for temperature regulation is designated as TC (temperature control), and where the control signals from TC for the different functions have been designated as S_1-S_4, and corresponding control signals for optimum defroster function (DF) have been designated as S'_1-S'_4. As can be seen from Figure 3, the signals from TC and the signals for optimum demisting are connected up to a means for selecting control signals, which means selects the control signal which gives optimum demisting. The number of control signals shown is four, which is of course only one example, since in principle any arbitrary number of control signals can be used in a device and a method according to the invention.

A suitable way of generating control signals for an optimum defroster function based on the value from the mist sensor is to use graphs or tables which give previously measured or calculated values for the different control signals depending on input data from the mist sensor. Examples of such graphs are those shown in Figure 2.

Figure 4 shows an alternative embodiment of the invention. Output data from the mist sensor is connected to a low-pass filter before the control signals are generated. This is done in order to ensure that regulation of the defroster function is not effected too quickly and in order to remove noise components in the output signal from the mist sensor. Another possibility is to filter those control signals which are generated by the defroster function in order to obtain different speeds of the different control signals.

The invention is not limited to the illustrative embodiments described above and instead can be freely modified within the scope of the attached patent claims. Of course, more than one sensor can be used at the same time to detect the presence of mist, and in this case the different sensors used can function according to different sensor principles. An example of a sensor principle other than an optic sensor is a moisture sensor. With the aid of the information from a moisture sensor and a temperature sensor, the dew point of the passenger compartment air can be calculated. The dew point can be compared with the temperature of the actual surface, for example a window, which is known from a temperature sensor or possibly from some form of estimating with the aid of a temperature model, which means that it is possible to estimate the risk of mist formation. The temperature of the window or of the surface can in such cases be measured using a contact-free technique, for example using an IR sensor.

As examples of other types of sensors which can be used instead of or in addition to the types of sensors described above, mention may be made, for example, of sensors which detect the number of persons in the car, the number of times the car doors are opened, which of the car doors are open, and detect whether the windscreen wipers of the car are in operation, which can be used as a sign of a high air moisture content.

A sensor can also be used to detect the presence of mist or ice on the rear window, and this could be used to control the electric wires which are used to demist the rear window. It is also conceivable to arrange electric wires on or in the windscreen and to control these according to the invention.

In warm and humid climates, mist can form on the outside of the windscreen as a result of blowing too much cold air onto the latter. This can be counteracted by having sensors for outside temperature and air humidity and allowing data from these sensors to act on the defroster function.

In another variant of the invention, the driver can act on the defroster function via a variable knob with which the driver indicates how much defroster function he wants.

As regards the tables for control signals which have been described above, values can either be taken directly from the tables, or the values found in the tables can be interpolated.

PATENT CLAIMS

1. Device for an automatic defroster function for a surface in a car, comprising a sensor for detecting the presence of mist or ice on said surface, means for generating control signals (S_1' - S_4'), on the basis of the sensor data, for a number of functions in the car for an optimum defroster function on said surface, and means (M) for receiving these control signals, and further comprising means (M) for receiving control signals (S_1 - S_4) from a temperature regulator in the car for a number of functions in the car, characterized in that

- a number of the control signals (S_1 - S_4) from the temperature regulator are intended to control the same functions as the control signals (S_1' - S_4') for the optimum defroster function,

- the same means (M) are used for receiving control signals for optimum defroster function and for receiving some of the control signals from the temperature regulator, and

- the means (M) for receiving control signals are intended, in the event of conflict, to select those control signals which are designed to give the best defroster function.

2. Device according to claim 1, in which the means for generating control signals for optimum defroster function include means for storing and reading off the values for each function, which values give the optimum defroster function for certain input data from the sensor for detecting the presence of mist or ice.

3. Device according to claim 1 or 2, in which the functions for which control signals can be generated by the defroster function include the speed of rotation of a fan, the air temperature after the car's air-conditioning, the degree of recovery of passenger compartment air, and the distribution of air in the car.

4. Method for achieving an automatic defroster function for a surface in a car, comprising detecting the presence of mist or ice on said surface, generating control signals (S_1' - S_4'), on the basis of said detection, for a number of functions in the car for an optimum defroster function on said surface, and receiving (M) these control signals, and further comprising receiving (M) control signals (S_1 - S_4) from a temperature regulator in the car for a number of functions in the car,

characterized in that a number of the control signals (S_1 - S_4) from the temperature regulator are intended to control the same functions as the control signals (S_1' - S_4') for optimum defroster function, and, in the event of conflict between some of the control signals from the temperature regulator and corresponding control signals from the defroster function, those control signals are selected which are designed to give the most demisting.

5. Method according to claim 4, in which the generation of control signals for optimum defroster function comprises reading off the stored values for each function, which stored values give an optimum defroster function for certain input data upon detection of the presence of mist or ice.

6. Method according to claim 4 or 5, in which the functions for which control signals can be generated for optimum defroster function include the speed of rotation of a fan, the air temperature after the car's air-conditioning, the degree of recovery of passenger compartment air, and the distribution of air in the car.

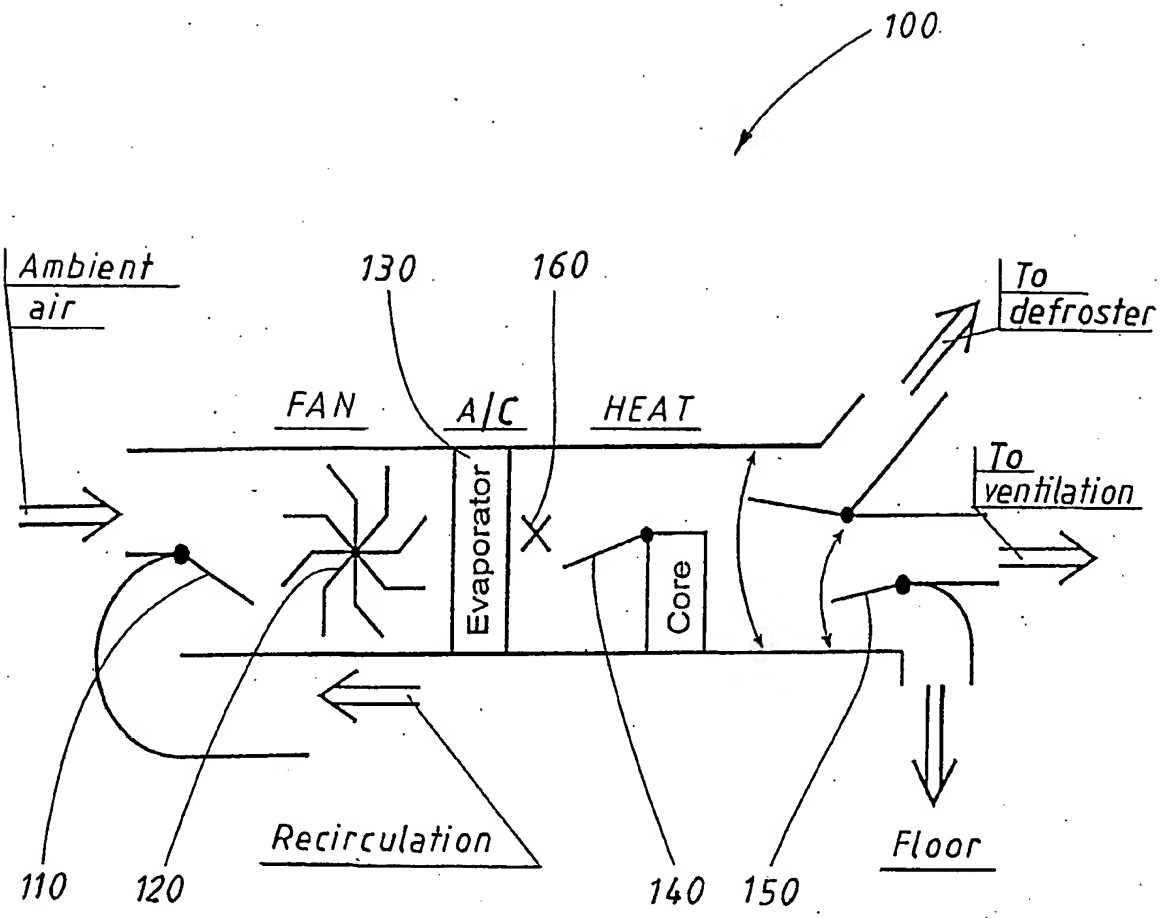
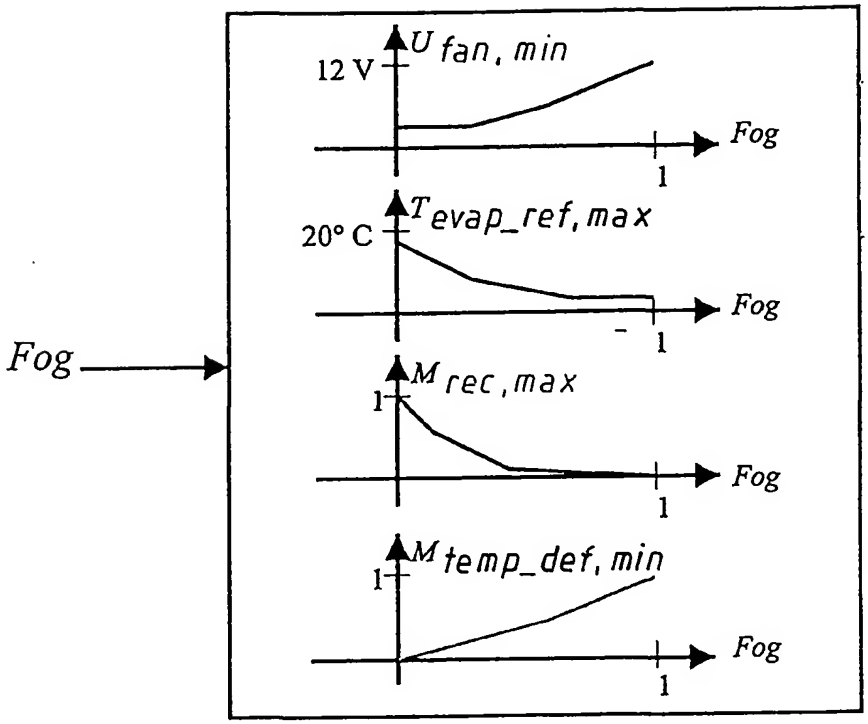

100
Ambient air
130
160
To defroster
FAN
A/C
HEAT
To ventilation
Evaporator
Core
Recirculation
Floor
110
120
140
150

FIG. 1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12 V
U fan, min
Fog
1
20° C
T evap_ref, max
Fog
1
M rec, max
1
Fog
1
M temp_def, min
1
Fog
1

FIG. 2

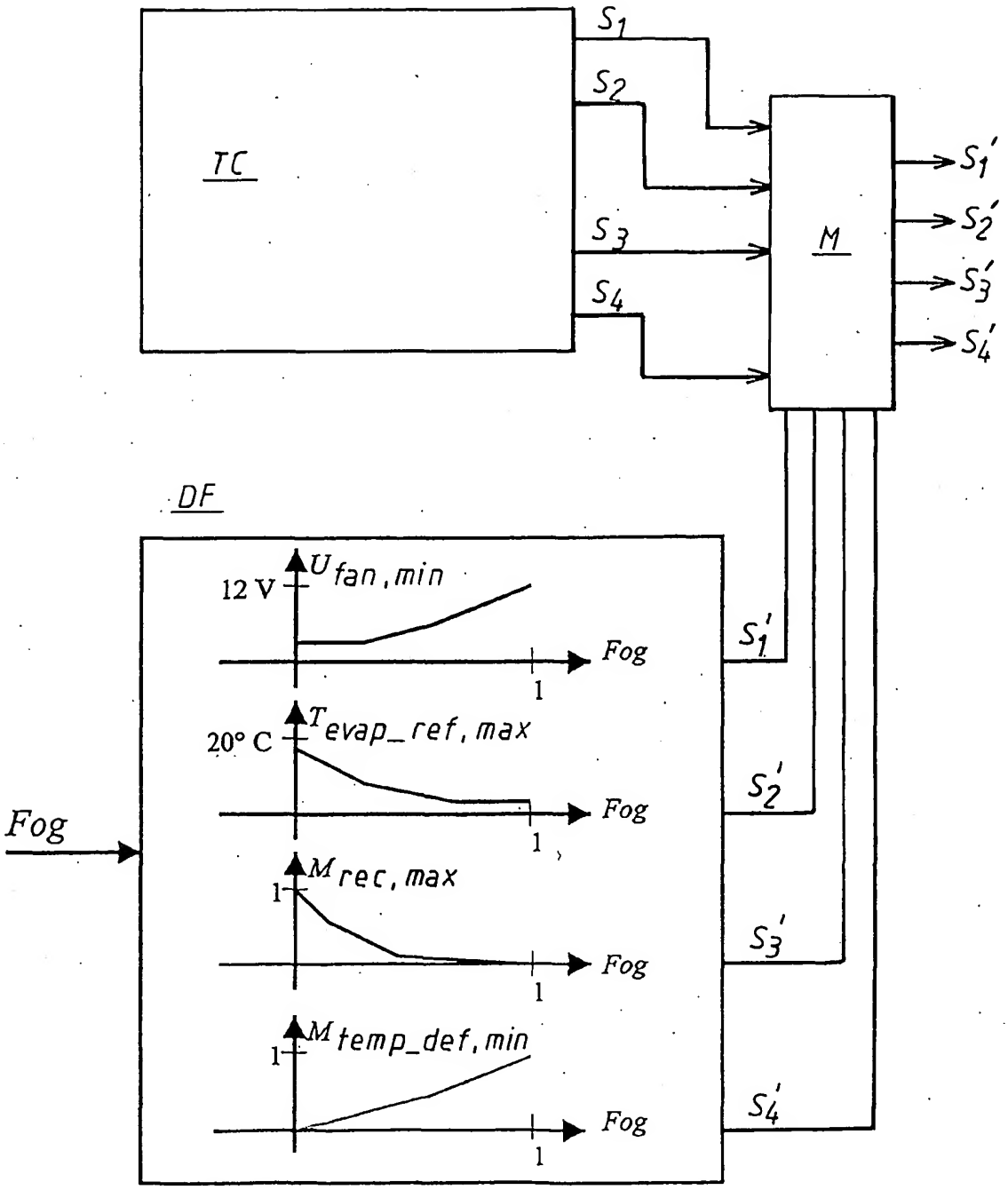
TC
S1
S2
S3
S4
M
S1'
S2'
S3'
S4'
DF
12 V
Ufan, min
Fog
1
20° C
Tevap_ref, max
Fog
1
Fog
1
Mrec, max
Fog
1
1
Mtemp_def, min
Fog
1
S1'
S2'
S3'
S4'

FIG.3

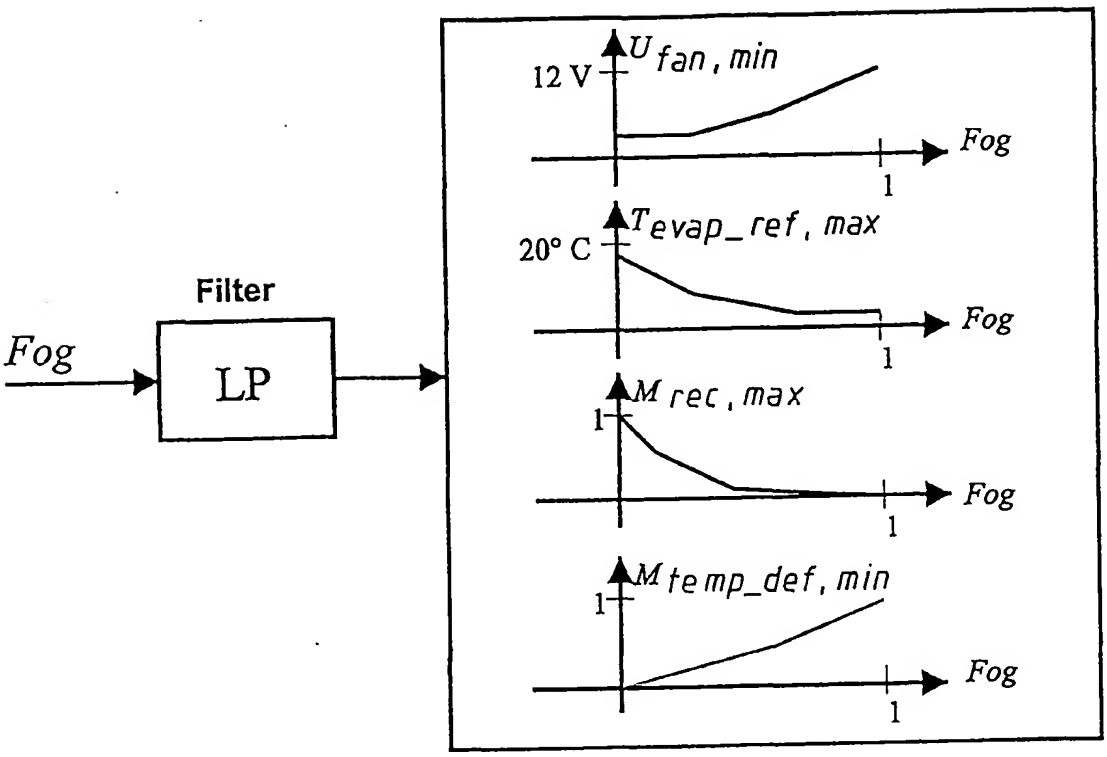
Filter
Fog
LP
12 V
U fan, min
Fog
1
20° C
T evap_ref, max
Fog
1
1
M rec, max
Fog
1
1
M temp_def, min
Fog
1

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/01572

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B60H 1/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B60H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5579994 A (DAVIS, JR. ET AL), 3 December 1996 (03.12.96), abstract --	1-6
A	US 5516041 A (DAVIS, JR. ET AL), 14 May 1996 (14.05.96), abstract --	1-6
A	US 4910967 A (TAKAHASHI), 27 March 1990 (27.03.90), abstract -- --------	1-6

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
8 October 2001	11 -10- 2001
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Göran Carlström/mj Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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